

SAVITSKIY, Ye. M.

USSR/Metals

Alloys

Aluminum - Magnesium

Nov 48

"Mechanical Characteristics of Alloys of the System Al-Mg," Ye. M. Savitskiy, M. A. Tylikina, Inst of Gen and Inorg Chem Jmenl N. S. Kurnakov, Acad Sci USSR, 3 pp

"Dok Ak Nauk SSSR" Vol IXIII, No 1

Experiments established that alloys friable at room temperature, placed under defined temperature-velocity conditions of deformation, behaved like plastic substances. Another great advantage

61/49T73

Nov 48

USSR/Metals (Contd)

in deformed alloys is their ability to approximate a state of equilibrium quickly as compared with cast alloys. Submitted by Acad G. G. Drazov 6 Sep 48.

61/49T73

ON THE TESTING OF MICROTENSILE SPECIMENTS. EM Savitskii and V.P. Lebedev. Zavodskaya Laboratoriya 1949, vol. 15, May, pp. 614-616. In Russian. Techniques suitable for the testing of specimens of diameters of the order of 1 mm are described. In these methods the specimens are held in a manner which facilitates testing at high temperatures.

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Structure of some aluminum magnesium alloys. R. M. Savitskii and M. A. Tytkin. *Doklady Akad. Nauk S.S.S.R.* 67, 81-3(1919); cf. C.I. 43, 21174. - Contrary to expectation, the hardness of Mg-Al alloys in the range 35.5-50% Mg, where the state diagram shows β or γ phases or their mixt., is additive only at low temps., but not from 300° upwards. At 300, 400, and 430°, the alloys are much more plastic than either the β or the γ phase; thus, at 430°, the hardness of the 38.0% Mg alloy is $1/3$ that of the γ and $1/2$ that of the β phase. X-ray diagrams of hot-extruded wire samples showed no structural changes on heating to 400° in the case of alloys consisting only of either the β or the γ phase. However, samples which, in the annealed state, at 20°, proved to be a mixt. of the β and the γ phase, e.g. 38.0% Mg, showed, at 400°, only lines of a single phase, different from both β and γ , closer to the latter but with a simpler lattice. Alloys with 38.9-41.3% Mg, heated to 400° and quenched in ice water, showed, in micrographv, one-phase structure, in contrast to the two-phase structure of the annealed alloys. The x-ray diagram of quenched sample, taken at 20°, was identical to that taken at 400°. Consequently, the anomaly of the high-temp. hardness curve as a function of the compn., in the 38.9-41.3% Mg range, is due to the single-phase structure of these alloys at higher temps. - N. T.

13

B

Production of Deformed Test Specimens From Inter-metallic Compounds. (In Russian.) E. M. Savitskii, V. V. Baron, and M. A. Tylkina. *Zavodskaya Labora-toriya* (Factory Laboratory), v. 15, June 1949, p. 729-732.

Develops method and apparatus for production of the above by hot pressing and hot extrusion. Shows that the concept of intermetallic compounds as brittle substances is correct only over a definite temperature range, and that such compounds be-have as plastic substances under certain conditions. Deformed test specimens of the intermetallic compounds of Mg/Zn, Mg/Zn, and Mg/Zn, and of the intermetallic β and γ phases in the Al-Mg system with different concentrations of compo-nents were obtained.

ASH-SLA METALLURGICAL LITERATURE CLASSIFICATION

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RESEARCH

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SAVITSKIY, Ye. M.

USSR/Chemistry - Systems
Chemistry - Magnesium, System: Zinc Feb 49

"Diagrammatic Structure and Mechanical Characteristics of the Mg-Zn System," Ye. M. Savitskiy, V. V. Baron, Inst Gen and Inorg Chem imeni N. S. Kurnakov, Acad Sci USSR, 4 pp

"Dok Ak Nauk SSSR" Vol LXIV, No 5

Tried to obtain deformed samples, and to experiment with samples processed by pressure, as well as those in a cast state. Placed particular stress on two points: (1) influence of the kinetics of establishing equilibrium in the form of a structural diagram of Mg-Zn, and diagram of composition and mechanical USSR/Chemistry - Systems (contd) Feb 49

characteristics, and (2) study of the effect of temperature on the mechanical characteristics of alloys enriched by intermetallic compounds. Submitted by Acad G. G. Urazov, 6 Dec 48.

29/4912

SAVITSKIY, Ye. M.

USSR/Metals - Manganese
Temperature, Influence
Sep 49

"The Influence of Temperature Upon the Mechanical Properties of Manganese," Ye. M. Savitskiy, V. F. Tereshova, Inst of Gen and Inorg Chem Acad Sci USSR, 3 pp

"Dok Ak Nauk SSSR" Vol LXVIII, No 1

Determined effect of temperatures from -195 to 1,240° upon mechanical properties of electrolytic manganese specimens. Hardness was determined directly while specimens were being heated in an electric furnace. Used dry ice and liquid nitrogen to cool specimens. Found that, in manganese, modification with simplest and loosest structure, characterized by least number of atoms in elementary lattice, i.e., gamma-modification, becomes stable in heating. Submitted by Acad G. G. Urazov 30 Jun 49.

2/50795

SAVITSKIY, Ye. M.

USSR/Metals - Testing, Equipment

Nov 50

"Universal Fixture for Micromechanical Tests," Ye. M. Savitskiy, Inst of Gen and Inorg Chem, Acad Sci USSR

"Zavod Lab" No 11, pp 1366-1371

Describes simple universal fixture which permits conducting almost all basic micromech tests at usual, as well as at high and low, temp in air, in vacuo or in protective media. Switching from one testing method to the other one is realized merely

180T82

USSR/Metals - Testing, Equipment (Contd)

Nov 50

by replacement of 2 parts. Fixture also makes possible prepn of tensile microspecimens by pressing and provides for some tech tests as, e.g. pressing capacity of metal powders.

180T82

CA

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Plasticity of the high-temperature modifications of polymorphic metals. E. M. Savitskiy. *Doklady Akad. Nauk S.S.S.R.* 73, 845-7(1950).—A literature survey showed that 16 of 19 polymorphic metals had a cu. lattice for their highest-temp. form, and, therefore, these metals had high plasticity at high temps. It should be possible to give high-temp. plasticity to a metal such as Mn that does not have a cu. high-temp. form by alloying it with a metal that would tend to give this result. Three % Cu was shown to produce ductile Mn. A. G. Gay

1951

SAVITSKIY, YE. M.

SAVITSKIY, YE. M. - "Investigation of the Effect of Temperature on the Mechanical Properties of Metallic Systems." Sub 24 Dec 52, Inst of General and Inorganic Chemistry imeni N. S. Kurnakov, Acad Sci USSR.
✓ (Dissertation for the Degree of Doctorates in Chemical Sciences).

SO: Vechernaya Moskva January-December 1952

USSR/Chemistry - Alloys

May/Jun 52

"The Mechanical Properties of Alloys of the System Magnesium-Cadmium," Ye. M. Savitskiy, V. V. Baron, Inst of Gen and Inorg Chem Imeni N. S. Kurnakov, Acad Sci USSR

"Iz Ak Nauk SSSR, Otdel Khim Nauk" No 3, pp 392-397

The mech properties of annealed and tempered Mg-Cd alloys at normal and at high temps were studied for the 1st time. Mechanical testing of annealed alloys confirmed that they contain Mg₃Cd, MgCd, and MgCd₃ at room temp. The curves of mech properties at 280 and 350°, and tempering beyond that temp showed no evidence of the presence of MgCd. MgCd, therefore, 220T2

is not formed by fusion or solid soln, but is a typical Kurnakov compd. Mg₃Cd, MgCd, and MgCd₃ form considerable regions of solid solns and are distinguished from the solid solns from which they are formed by their higher plasticity and lower hardness.

SA ITSKIY, Ye. M.

220T2

SAVITSKIY, Ye. M.

British Abstracts

31, July 1953

Strength Properties

and Physical

Metallurgy

Measurement of internal pressures originated in polymorphous metals on heating. E. M. Savitskii and V. F. Terekhova (C. R.

Acad. Sci. U.R.S.S., 1952, 87, 787-789).—Samples (cylindrical specimens 15 mm. diam., 30 mm. long) of Armco Fe and Mn are heated in an apparatus which measures the internal stresses developed in them. The results are represented in form of internal stress-temp. diagrams. They are in agreement with the change of mechanical properties of these materials on heating, and polymorphic changes are easily identifiable on the internal stress-temp. curves. The internal stresses in Armco Fe do not exceed 0.45 kg./mm.² due to small volume changes but in Mn they reach the value of 50 kg./mm.² at about 950°. S. K. LACHOWICZ.

SAVITSKIY, Ye. M.

(Inst. Gen and Inorg. Chem im. N. S. Kurnakov, Moscow)

"The Dependence of the Mechanical properties of metals on Temperature in connection with their crystal structure." Dokl. Akad. Nauk SSSR, 89, 85-88, 1953.

For pure metals the change of mech. properties with temp. depends on how much their crystal structure is affected by temp. changes. From this point of view pure metals can be divided into 3 groups. (1) Metals for which temp. changes do not result in a change of crystal structure. For these metals phys. properties show no drastic changes with temp., and the changes are continuous. All monomorphic metals with cubic space lattice structures belong to this group. In with its dense tetragonal lattice structure can included. (2) Metals that at room temp. have poor plasticity but develop new slip planes when heated. The plasticity of these metals is greatly increased in certain temp. ranges but the changes also are continuous. All monomorphic metals with hexagonal lattice structure belong to this group. The drastic increase of plasticity of such metals at elevated temps. can be demonstrated particularly well for Mg at temps. between 300 and 600°. Zn and Cd behave much like Mg. Information on many other metals with hexagonal lattices is lacking. Metals with rhombohedral and orthorhombic lattices might behave in the same manner, but information on them is lacking. (3) Allotropic metals. For these metals temp. changes are accompanied by changes in the crystal structure. The resulting changes in the phys. properties are severe and discrete. They are most pronounced when the lattice structure changes from one that is unfavorable to plasticity to one that enhances plastic deformation. The high temp. forms of most of the allotropic metals are of the cubic space lattice type. As a rule, therefore, the highest-temp. forms of an allotropic metal must be the most plastic. This rule can be used: (1) to select the correct addns. to an alloy to stabilize its high temp. crystal structure; (2) to use the best temps for hot-working of allotropic metals; (3) to verify that the high temp. forms of allotropic metals must be of the cubic type, and by the same token, to det. the crystal structures at high temps for those that have not been investigated.

SAVITSKIY, Ye.M.

Obtaining double salts under pressure. I. N. Lomashkin, C
 E. M. Savitskiy, and Kh. B. Fradkina. *Izvest. Sektora Fiz.-*
Khim. Anal. Inst. Obshchei i Neorg. Khim., Akad. Nauk H(2)
S.S.S.R. 25, 144-9 (1951). The data suggest that under
 pressure deposits of single salts may form double salts.
 Double salts $\text{NaSO}_4 \cdot \text{CuSO}_4$, $\text{KCl} \cdot \text{MgSO}_4 \cdot 3\text{H}_2\text{O}$, $\text{K}_2\text{SO}_4 \cdot$
 $\text{CaSO}_4 \cdot \text{H}_2\text{O}$, and $\text{K}_2\text{SO}_4 \cdot \text{MgSO}_4 \cdot 6\text{H}_2\text{O}$ were synthesized at
 high pressure and at 20 or 50°. Eurilla Mayerle

SAVITSKIY, Ye.M.

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AEC-tr-2494

THE EFFECT OF TEMPERATURE ON THE STRENGTH OF
BRITTLE METALLIC SUBSTANCES. V. V. Baron and
K. M. Savitskiy. Translated by F. L. Yaggee from Doklady
Akad. Nauk S.S.S.R. 94, 269-72(1954). 6p.

Measurements taken of the temperature effects on brittle
metallic compounds showed that the initial strength of such
materials increases with the increase of the temperature,
reaches the maximum value, and then begins to decrease
according to the exponential law, while their plasticity con-
tinues to increase with the temperature. Analysis is made
of temperature effects during compression and tension.
Tabulations are given for variations in strength and plasticity
of brittle metals, metallic compounds, and plastic metals
and alloys. Tests were made with samples of Cu, Co, Si, Co,
Ni and their compounds. (R.V.J.)

Metal

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LFH

VNH

SAVITSKIY, Ye.M.

Effect of temperature on mechanical properties of lan-
thanum and cerium. E. M. Savitskiy and V. F. Terekhova
(N. S. Kurnakov Inst. Gen. Inorg. Chem., Moscow)
Khim. Redkikh Elementov, Akad. Nauk S.S.S.R., Inst.
Obshchei i Neorg. Khim. 1955, No. 2, 148-55. The effect
of temp. on mech. properties of La and Ce was detd. in re-
spect to hardness, tensile strength, relative contraction in
static compression, and change in cross section of a specimen
under tension, at 20-800° for La and 20-600° for Ce. Poly-
morphic transformation ranges are at 500-600° for La and
350-400° for Ce. The temp. of max. plasticity is 700° for La
and 450° for Ce. The results, shown graphically, indicate
that the rule concerning the greatest plasticity of high-temp.
modifications of polymorphic metals is correct (S. Doklady
Akad. Nauk S.S.S.R. 59, 85(1953); C.A. 45, 7493i).
G. M. Kosolapoff

SAVITSKIY, Ye. M.

Effect of temperature on mechanical properties of Germanium. E. M. Savitskiy and V. F. Terekhova (N. S. Kurnakov Inst. Gen. Inorg. Chem., Moscow). *Khim. Redkikh Elementov, Akad. Nauk S.S.S.R., Inst. Obshchei i Neorg. Khim.* 1955, No. 2, 156-60.—Hardness, compressive strength, and relative shrinkage under pressure were detd. for Ge in the temp. interval from 20° to 950°. Above 900°, the ordinarily brittle metal becomes capable of plastic deformation. A 2-3 fold increase of hardness takes place in Ge near its m.p. The phenomenon can be explained by the appearance of ability toward plastic deformation.
G. M. Kosolapoff

SAVITSKIY, Ye. M.
USSR/Engineering - Metallography

FD-2618

Card 1/1 : Pub. 41-4/21

Author : Savitskiy, Ye. M. and Tylkina, M. A., Moscow

Title : The effect of temperature on the plasticity and resistance to deformation of commercial titanium

Periodical : Izv. AN SSSR, Otd. Tekh. Nauk 4, 53-57, Apr 55

Abstract : Presents the results of an experimental determination of plasticity and resistance to deformation at various temperatures and under various stresses of commercial carbon-free titanium and of titanium with an 0.5-0.8% carbon content. The presence of carbon within this range was found to increase the strength and decrease the plasticity at temperatures of 20-600°. It was found that carbon does not decrease the plasticity of titanium at temperatures of 700-800° and over and permits the hot deformation of titanium under low stresses. Graphs. Four USSR references.

Institution :

Submitted : February 11, 1955

Translation W-31633, 3 Feb 56

SAVITSKIY, Ye M.

Recrystallization studies of titanium and its alloys. B. M. Savitskiy, M. A. Tykina, and A. M. Turanskaya. *Izv. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk* 1955, No. 7, 111-13. The Ti recrystn. diagram was studied on an iodide metal, Mg-thermal Ti, and CaH₂ powder-metallurgical sample by x-ray and microscopic methods. The coarse crystal structure was destroyed by a previous 50% deformation and annealing at 650°, with the production of fully recrystd. α -Ti polyhedric structure. The samples were further deformed by cold-rolling to 80%, and annealed in vacuo at 500-1300° for 1 hr. The results are presented in the grain-size-percentage deformation-annealing temp. space diagram, and in microphotographs after annealing at 1100° and quenching from 1600°. The recrystn. results presented diagrammatically, are considered as being composed of the α - and β -modifications crystn. in their stability temp. range in view of the different growth tendency of the 2 modifications. The α -modification is characterized by the finely crystd. polyhedric particle structure; independent of the cooling rate and the crit. particle size after cold-rolling to 2.5-7% deformation. The β -particle size is greater, they are highly sensitive to the cooling rate, which produces a difference in the shape and size of the hexagonal α' -modification during the polymorphous β - α' transformation. The particle boundaries in the iodide and Mg-thermal Ti are retained at all cooling rates, and can only be destroyed by deformation in the β -state, while in the CaH₂ Ti the β -particle outlines are only retained with rapid cooling. The optimum annealing temp. is 650-850° and depends on the purity of the metal and the extent of the previous deformation. Forging and rolling at 0.5 m./sec. rate, results in no Ti recrystn. Recrystn. may, however, occur at subsequent heating, during the cooling of large billets, or any other subsequent working of the hot material. W. M. Sternberg

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SAVITSKIY, YE. M.

USSR/ Physics - Plasticity

Card 1/1 Pub. 86 - 8/38

Authors : Savitskiy, Ye. M.

Title : ~~On the plasticity of some brittle metallic substances~~
On the plasticity of some brittle metallic substances

Periodical : Priroda 44/7, 60 - 64, Jul 1955

Abstract : Metals which are brittle under ordinary conditions are subjected to experimentation to determine the change in their plasticity under varying conditions, such as changes in temperature and compounding with other elements. Instances are given of brittle metals which become extremely plastic at high temperatures. The study covers the crystal and micro-structure of various metals, alloys and other compounds. Illustrations; graph; diagram.

Institution :

Submitted :

SAVITSKIY Ye. M.

USSR/Physics - Metallurgy

Card 1/1 Pub. 22 - 19/51

Authors : Savitskiy, Ye. M.; Tylkina, M. A.; and Turanskaya, A. N.

Title : ~~Diagram of the recrystallization of iodide titanium~~
Diagram of the recrystallization of iodide titanium

Periodical : Dok. AN SSSR 101/5, 857-859, Apr. 11, 1955

Abstract : A study of the dependence of the magnitude of iodide titanium grains and their degree of deformation on the annealing temperature is described. On the basis of the data obtained, a diagram of recrystallization of iodide titanium was constructed which shows a double modification of iodide titanium crystals: α - hexagonal, and β - cubical forms. Graph; illustrations.

Institution : Acad. of Sc., USSR, A. A. Baykov's Institute of Metallurgy

Presented by : Academician I. P. Bardin, January 28, 1955

SAVITSKY, YE. M.

Savitsky, Ye. M., Tylkina, M. A., "Rhenium and its Alloys."
in book Research on Heat Resistant Alloys, pub by Acad. Sci. USSR,
Moscow, 1956, 160pp.

Inst. Metallurgy im A. A. Baykov

Translation from: Referativnyy zhurnal. Metallurgiya, 1957, Nr 1, p 198 (USSR)
SOV/137-57-1-1489

AUTHORS: Savitskiy, Ye. M., Tylkina, M. A.

TITLE: Rhenium and Its Alloys (Reni i yego splavy)

PERIODICAL: V kn.: Issledovaniya po zharoprochnym splavam. Moscow, AN SSSR, 1956, pp 33-47

ABSTRACT: The authors investigated the structure and properties of alloys of Re with Mo at different temperatures. The specimens were prepared by the cermet method. Specimens of cast Re were obtained by melting briquettes prepared from powder in an electric-arc furnace in an Ar atmosphere, at 200-mm Hg pressure. Introduction of 1, 3, 5, 10, 25, and 50 weight-% Re does not cause any changes in the micro-structure; the Re dissolves in the Mo, and all these alloys have a single-phase structure of a substitution-type solid solution. The alloy with 75% Re is an intermetallic compound, expressed by the stoichiometric ratio Mo_2Re_3 . With an increase in Re content up to 25-50% the hardness of the alloy increases; the alloy with 75% by weight of Re has the maximum hardness equal to 1120 kg/mm². A lowering of the temperature to -194°C brings about an increase in hardness; raising the

Card 1/2

SOV/137-57-1-1489

Rhenium and Its Alloys

temperature causes a decrease in hardness. A 90% Re alloy with a 550-kg/mm² hardness at room temperature maintains a 390-340 kg/mm² hardness in the 400-800° temperature range and 220 kg/mm² at 1150°. All specimens except the 75% Re alloy proved fairly ductile. Their compressive $\sigma_b > 200$ kg/mm². At 10000 all alloys exhibited fair ductility, except for the 75% Re alloy which disintegrated into powder. The 90% Re alloy possesses good ductility both at low and at elevated temperatures. In order to establish whether this alloy can be employed as a heat-resistant material, it should be tested for its stress-rupture properties. A vast amount of material on the physical and mechanical properties of Re is set forth in this work; phase diagrams of alloys of Re with W, Fe, Co, Cr, Mo, and Ni, microstructures of cast Re-Mo alloys, and curves of their hardness and ductility at different temperatures are given. The authors also touched on the problems of the use of Re in the national economy.

Ye. K.

Card 2/2

SAVITSKIY, YE M.

137-58-1-1909

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 1, p 256 (USSR)

AUTHORS: Savitskiy, Ye.M., Baron, V.V.

TITLE: The Hardness and Ductility of Molybdenum-base Alloys
(Tverdost' i plastichnost' splavov na osnove molibdena)

PERIODICAL: V sb.: Prochnost' metallov, Moscow, AN SSSR, 1956, pp 144-161

ABSTRACT: An investigation is made into the properties and microstructure of cast Mo alloys with B, Si, Ti, V, Cr, Zr, Nb, Ta, and W added in quantities of 10 and 20 percent, and also of alloys containing up to 0.5 percent Al and up to 0.2 percent C. The specimens were smelted in an electric arc furnace in an Ar atmosphere. Hardness (H) was measured at room and elevated (1150°) temperature, while the ductility of the alloys was determined by upsetting specimens in a press. The H of Mo at 20° is increased 3-4 times by additions of B, Si and Zr. A considerable increase in H is observed on introduction of 15 percent Cr and 1 percent B. Additions of 1-20 percent W do not increase the H of Mo. An insignificant increase in H is observed when V, Nb, and Ti (Ti+1 percent B) is added to Mo. At 1150°, the greatest increase in H is observed on addition of B, Si, and Zr to Mo. V, Ta, and Nb also significantly

Card 1/2

137-58-1-1909

The Hardness and Ductility of Molybdenum-Base Alloys

increase the strength of Mo at 1150°. The least effect is caused by Ti and W. At 1150°, the reduction of H is greatest in alloys containing B, Si, Zr, V, and Ta when the content of these elements is up to 10 percent, when the Nb and Cr content is up to 5 percent, and with W up to 20 percent. The alloy containing Ti has the greatest softening effect. Addition of K > 0.2 percent to Mo causes a pronounced reduction in the ductility of Mo, and when there is > 5 percent B, the alloys become embrittled. The ductility of an Mo-Si alloy drops sharply when the Si content exceeds 0.32 percent, and it is zero at 3.5 percent Si. Alloys containing up to 5 percent Ti will take deformation without the appearance of cracks, but higher Ti content (20 percent) renders them brittle. The ductility of alloys diminishes with increasing Cr content (over 0.2 percent to 5 percent Cr), but beyond that it shows little change, while as Nb and Ta increase to 5 percent it increases, after which it undergoes a pronounced drop and is 5 percent at 20 percent Nb, and 24 percent at 10 percent Ta. Specimens containing 15-20 percent V fail under compression. Mo-W alloys will undergo 20 percent deformation without cracks (at 10 percent W and 1 percent B). Bibliography: 16 references.

Ye.K.

1. Alloys--Hardness
 2. Alloys--Ductility
 3. Alloys--Microstructure
 4. Alloys--Properties
- Card 2/2

S. SAVITSKIY / Y. M.

E-8

USSR / Structure of Deformed Materials.

Abs Jour : Ref Zhur - Fizika, No 4, 1957, No 9399

Author : ~~Savitskiy, Ye.M.~~ Tlylkina, M.A., Turanskaya, A.N.

Inst : None

Title : Investigation of the Recrystallization of Titanium and of its Alloys (I. Diagrams of Recrystallization of Titanium).

Orig Pub : Izv. AN SSSR, Otd. tekhn. n., 1956, No 7, 111-114

Abstract : The method of microstructure and X-ray investigation was used to plot volume diagrams for crystallization: (1) For titanium iodide I at cold rolling and annealing in the interval from 500 -- 1300°. (2) For arc-melted magnesium thermic titanium alloy VT1 -- D of type I in cold deformation by compression and annealing at 500 -- 1400° and of type II in hot deformation by dynamic compression in the range 600 -- 1300° (a) with subsequent annealing and (b) with subsequent annealing, corresponding to the forging temperature. (3) For calcium-hydride metal-ceramic tita-

Card : 1/2

E-8

USSR / Structure of Deformed Materials.

Abs Jour : Ref Zhur - Fizika, No 4, 1957, No 9399

Abstract : nium of type II at hot rolling in the range from 500 -- 1200° (a) without annealing and (b) with annealing. It was established that owing to the presence of polymorphism and owing to the different ability of the α and β modifications to grow grains, each diagram can be considered so to speak as consisting of two diagrams, corresponding to the temperature regions of the 2 modifications of Ti. The character of the change in the microstructure of titanium as a function of the deformation and heating conditions was shown. The start of recrystallization takes place in titanium iodide at a 50% deformation and 500°, at a 5% deformation and 600° and in the case of magnesium-thermic titanium the admixtures increase somewhat the recrystallization temperature. In the region of small deformations, from 2.5 to 5%, there exists in the α region a recrystallization threshold, which is absent from the β -region of the diagram.

Card : 2/2

SAVITSKIY, Ye.M., professor, doktor khimicheskikh nauk.

Rare-earth metals. Nauka i zhizn' 23 no.3:63 Mr '56. (MLRA 9:7)
(Earths, Rare)

SAVITSKY, V.M.
SAVITSKY, V.M.

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260/13/3

669.295-153

The Effect of Annealing Temperatures
on Mechanical Properties and Micro-
structure of Titanium

Izv. Akad. Nauk,
Otd. tekhn. Nauk.
(10), 125-127
1956

E.M. Savitsky, M.A. Tylicina

U.S.S.R.

Structure and mechanical properties of magnesium-thermo titanium and iodide titanium were studied as a function of annealing temperature ranging in the interval 600-1,300 deg.C. It has been established that mechanical properties were indicative of structural changes in titanium. Conditions are formulated in which α -titanium can be obtained possessing optimum mechanical properties. Bibl.2.

Trans. W-3, 053, 32, 13 Feb 57

POB MK JP

SAVITSKIY, Ye.M

18 18
Investigation of the Recrystallization of Titanium and
Its Alloys. II. The Recrystallization Diagram of Titanium
Alloys. Yu. A. Zol'tov, E. M. Savitskiy, M. A. Tytkin, and
A. N. Turanskaya (Izvest. Akad. Nauk S.S.S.R., 1958,
[Tekhn.], (8), 136-138). (In Russian). Cf. S. et al. (7),
111; preceding abstract. Recryst. diagrams were constructed
by metallographic and X-ray analysis for cast alloys based
on Ti from the Mg process—V.T.2—and powder-met. alloys
based on Ti from the CaH₂ process. During hot-forging
or hot-rolling at 0.5 m./sec. there is no recryst.; this takes

place during the subsequent heat-treatment. If V.T.2 is
heated above the polymorphic transformation temp. and
quenched the outlines of the β grains can be seen. They can
be removed by tempering and slow-cooling. N. E. B.

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4 7

SAVITSKIY, YE. M.

Category : USSR/Solid State Physics - Mechanical Properties of Crystals and Polycrystalline Compounds E-9

Abs Jour : Ref Zhur - Fizika, No 2, 1957 No 3950

Author : Savitskiy, Ye. M., Baron, V. V.

Inst : Institute of Metallurgy, Academy of Sciences USSR.

Title : Concerning the Additiveness of Mechanical Properties of Metallic Alloys and Mixtures.

Orig Pub : Izv. Sektora fiz.-khim. analiza IONKh AN SSSR, 1956, 27, 86-96

Abstract : Using the systems Mg-Si, Mg-Ge, Cu-Si, Al-Cu, Ni-Si, and Co-Si as examples, it is shown that the mechanical properties of two-phase metallic alloy-mixtures depend substantially on the mutual distribution of the structure of components in these mixtures. The presence of a soft component (for example, a eutectic component), distributed over the boundaries of the solid phase, causes a sharp reduction in the hardness of the alloy. No additive dependence of the properties on the composition is observed in this case. If the soft component is located in the alloy in the form of individual inclusions and if the structure is in general broken up, the character of the dependence of the properties on the

Card : 1/2

Category : USSR/Solid State Physics - Mechanical Properties of Crystals and Polycrystalline Compounds. E-9

Abs Jour : Ref Zhur - Fizika, No 2, 1957 No 3950

composition is closer to additive. Such a distribution of the components can be obtained if there is a small difference in their melting points (Cu-Al), particularly by hot deformation of cast alloys; if the difference in the melting temperatures is considerable (Al-Si, Mg-Si, Cu-Si), the metal-ceramic method is more effective. The mechanical properties of the Cu-Al alloys at higher temperatures approach additiveness to a greater extent owing to the strong softening of the Cu-Al₂ compound. In solid solutions based on the Mg-Zn, Mg-Zn₂ and Mg-Zn₅ compounds, the hardness also varies linearly with the composition at ordinary and high temperatures.

Card 2/2

SAVITSKIY, YE. M.

USSR/Inorganic Chemistry - Complex Compounds, C

Abst Journal: Referat Zhur - Khimiya, No 19, 1956, 61246

Author: Savitskiy, Ye. M.

Institution: None

Title: Rare Metals

Periodical: Priroda, 1956, No 4, 24-30

Abstract: None

Card 1/1

Savitskiy, Ye. M.
USSR/ Physics - Technical physics

Card 1/1 Pub. 22 - 22/54

Authors : Savitskiy, Ye. M.; Tylkina, M. A.; and Turanskaya, A. N.

Title : Mechanical properties of iodide titanium

Periodical : Dok. AN SSSR 106/2, 254-257, Jan 11, 1956

Abstract : An experimental study of the mechanical properties of metallic titanium (iodide titanium) is presented. The experiments were conducted to determine the effect of temperature on the durability, plasticity and other mechanical characteristics of iodide titanium. Ten references: 5 USA, 5 USSR (1953-1955). Illustrations; graphs; tables.

Institution :

Presented by: Academician I. P. Bardin, July 11, 1955

SAVITSKIY, YE M.

3

✓ 1890
CHROMIUM RECRYSTALLIZATION DIAGRAM. E. M. Savitskii, V. F. Terikhova, and A. V. Kholopov. (Baikov Inst. of Metallurgy). Doklady Akad. Nauk S.S.S.R. 109, 704-5 (1958) Aug. 1. (In Russian)

A phase diagram was constructed for recrystallization of commercially pure electrolytic Cr. The chemical analysis of the Cr refined in hydrogen at 1350°, for 70 to 100 hr gave the following results (in % Cr, 99.5; N, 0.1; C, 0.01 to 0.04; Si, 0.05; Fe, 0.1; Ni, 0.1; and O₂, 0.005. The microstructure of deformed and recrystallized specimens is shown. Tabulations are made of the Cr grain alterations and microhardness in relation to deformation and temperature of annealing. (R.V.J.)

MOGUCHIIY, Leonid Nikolayevich; SAVITSKIY, Ye. M., otvetstvennyy redaktor;
PINKHUSOVICH, L.L., redaktor izdatel'stva; ZEMLYAKOVA, T.I.,
tekhnicheskiy redaktor.

[Working metals under pressure] Obrabotka metallov, davleniem.
Moskva, Izd-vo Akad.nauk SSSR. 1957. 198 p. (MIRA 10:4)
(Metalwork)

SAVITSKIY, Yevgeniy Mikhaylovich; AGEYEV, N.V., otvetstvennyy redaktor;
MIKHAIL'SON, E.M., redaktor izdatel'stva; KISELEVA, A.A., tekhnicheskiiy redaktor.

[Effect of temperature on mechanical properties of metals and alloys] Vliianie temperatury na mekhanicheskie svoistva metallov i splavov. Moskva, Izd-vo Akad.nauk SSSR, 1957. 294 p. (MIRA 10:6)

1. Chlen-korrespondent AN SSSR (for Ageyev, N.V.)
(Metals, Effect of temperature on)

137-58-4-75

Savitskiy, Ye. M.
Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 2, p 278 (USSR)

AUTHORS: Savitskiy, Ye. M., Terekhova, V. F.

TITLE: The Influence of Temperature on the Mechanical Properties of Cobalt (Vliyanie temperatury na mekhanicheskiye svoystva kobal'ta)

PERIODICAL: Tr. In-ta metallurgii. AN SSSR, 1957, Nr 1, pp 153-157

ABSTRACT: A study was made of the hardness, strength, and plastic properties of Co under tensile and compressive stresses, also of its σ_k at temperatures of 20-1200°C. The specimens were prepared by remelting a grade K-2 cobalt in a high-frequency furnace, whence it was suction-drawn into porcelain tubes 11-12 mm in diameter. The hardness was measured in the 50-1000 range by means of a "pobedit" cone loaded with an indentation force of 100 kg. Static compression was exerted in a hydraulic press until the first cracks appeared. Specimens 3 mm in diameter were tensile-tested in a Gagarin testing machine. The σ_k value was determined for specimens 10 mm in diameter bearing circular notches 2 mm deep. It was found that the rate of decrease in Co hardness from 187 kg/mm² (for temperatures up

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137-58-2-4224

The Influence of Temperature on the Mechanical Properties of Cobalt

to 20°) to 15 kg/mm² (at 1100°) abruptly steepened in the 300-450° range. Under compression, σ_b declined moderately (up to 450°), then (in the region of β -Co) it increased noticeably, accompanied by a change from brittle to ductile fracture. The magnitude of σ_b dropped from 13 kg/mm² at 20° to 1.4 kg/mm² at 800°; δ increased by 3%. Reduction in area (necking) increased until the temperature reached 400°, but then diminished as the temperature rose further. The α_k -versus-temperature curve had two maxima, at 350° & 500°, with a min. at 400°. A hypothesis is advanced to the effect that the abrupt change in the mechanical properties of the Co in the 350-450° temperature range is linked to its polymorphous transformation.

Yu. L.

1. Cobalt--Mechanical properties--Temperature effects

Card 2/2

137-1957-12-25299

Translation from: Referativnyy zhurnal, Metallurgiya, 1957, Nr 12, p 334 (USSR)

AUTHORS: Savitskiy, Ye. M., Tylkina, M. A.

TITLE: Mechanical Properties of Cast Rhenium (Mekhanicheskiye svoystva litogo reniya)

PERIODICAL: Tr. In-ta metallurgii. AN SSSR, 1957, Nr 1, pp 158-161

ABSTRACT: Castings of Re to be investigated were obtained by melting sintered powdered metal in an argon-arc furnace. Hardness tests, conducted in the temperature range between -194° and $+1150^{\circ}$, showed that H_k varies from 400 kg/mm² to 134 kg/mm², respectively. Plasticity was determined at 20° and 1000° . At 20° and a compressive σ_p of 200 kg/mm², the compression was 25-30 percent. At 1000° the compression was 60 percent. Cold working increases the hardness by approximately 80 percent. Recrystallization begins at approximately 1500° . Bibliography: 7 references.

P. N

Card 1/1

1. Rhenium castings-Mechanical properties-Test results

SOV/124-58-4-4851

Translation from: Referativnyy zhurnal, Mekhanika, 1958, Nr 4, p 163 (USSR)

AUTHORS: Savitskiy, Ye. M., Terekhova, V. F.

TITLE: Temperature Effect Upon Mechanical Properties of Alkaline-earth Metals (Vliyaniye temperatury na mekhanicheskiye svoystva shchelochnozemel'nykh metallov)

PERIODICAL: Tr. In-ta metallurgii. AN SSSR, 1957, Nr 1, pp 162-169

ABSTRACT: Experimental investigations as to the effect of temperature on the hardness, strength, and ductility under tension were performed on specimens of metallic magnesium, calcium, strontium, and barium. Experiments were carried out in an atmosphere of argon on specially constructed testing installations suitable for samples of limited dimensions. The results showed that the samples investigated were graded in the following order according to decreasing hardness and strength and increasing ductility: magnesium, calcium, strontium, and barium. With an increase in temperature all of the metals softened quickly and at 500-550°C the strength and hardness became comparable.

Card 1/1

1. Alkaline earths--Mechanical properties From the résumé
2. Alkaline earths--Temperature effects

SAVITSKIY, YE.M.

137-58-5-10599

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 5, p 248 (USSR)

AUTHORS: Savitskiy, Ye. M., Trapeznikov, V. A.

TITLE: Evaluating the Transition of Chromium From the Brittle to the Ductile State (K voprosu ob otsenke perekhoda khroma iz khrupkogo sostoyaniya v plastichnoye)

PERIODICAL: V sb.: Issled. po zharoprochn. splavam. Vol 2. Moscow, AN SSSR, 1957, pp 141-147

ABSTRACT: A study is made of the possibility of determining the temperature of Cr transition from the brittle to the ductile state by static testing for compression along a single axis and by measurement of hardness. A design of a device for hot tests for static monoaxial compression is presented. The experiments were run with electrolytic Cr, reduced in a current of dry and purified H₂ and then resmelted in a current of technical Ar in an induction furnace. Experiments were also run with industrial aluminothermic Cr, resmelted in similar fashion in a current of technical Ar. It is established that in an interval ranging from room temperature to 250°C for electrolytic Cr and to 300° for aluminothermic Cr, the ductility (D) changes insignificantly,

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137-58-5-10599

Evaluating the Transition of (cont.)

and in this temperature interval Cr displays brittle failure (F). At temperatures of $\sim 250^{\circ}$ and 300° , depending upon the degree of purity, Cr reveals a sharp transition from a region of brittleness to a state of ductility, terminating at about 400° , after which a gradual smooth rise in D is observed and the metal exhibits ductile F. It is shown that the purer the Cr and the higher the temperature and lower the time rate of elongation applied to the metal, the greater its D and the lower the temperature of transition from the brittle to the plastic state. Hardness tests showed that the hardness method also affords a fairly precise determination of the temperature at which the transition of Cr to the region of ductile F terminates and an evaluation of the influence of the level of purity of the metal upon its D on heating.

V. N.

1. Chromium--Phase studies
2. Temperature--Determination

Card 2/2

SOV/137-58-7-15957

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 7, p 289 (USSR)

AUTHORS: Savitskiy, Ye.M., Terekhova, V.F.

TITLE: Investigation of the Mechanical Properties and Construction of the Diagram of the Recrystallization of Chromium (Issledovaniye mekhanicheskikh svoystv i postroyeniye diagrammy rekristallizatsii khroma)

PERIODICAL: V sb. Issled. po zharoprochn. splavam. Vol 2. Moscow, AN SSSR, 1957, pp 148-157

ABSTRACT: The effect of temperature on the hardness, plasticity, and strength during stretching and compression and also the σ_k of Cr of various grades of purity, namely, hydride (98.5%), aluminothermic (98.9%) and electrolytic (99.5%) was investigated. Aluminothermic Cr has the greatest hardness at room temperature. Its σ_b is 4.7 kg/mm², while that of the electrolytic Cr is 17 kg/mm². The critical point of the brittleness of Cr depends upon its purity. Upon compression the aluminothermic Cr is transformed from the brittle state into the malleable at 300°C; the electrolytic Cr is similarly transformed at 200-250°. Upon a rise of temperature Cr

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SOV/137-58-7-15957

Investigation of the Mechanical Properties and Construction (cont.)

softens considerably. During the transition into the plastic state a certain increase in hardness is observed in Cr of all types at 350-450°. At 1000° electrolytic Cr subjected to monoaxial compression can withstand a single-stroke 90% upsetting without failure. In the 500 to 700° range impact specimens without a notch do not break but bend plastically. In this temperature range Cr can be worked by pressure. A specific characteristic of Cr is its increase in strength with a rise in temperature. This is especially true for impure Cr. The σ_b of aluminothermic Cr increases from 4.7 at 20° to 10 at 1100°, that of electrolytic Cr from 17 at 20° to 28 kg/mm² at 500°. X-ray investigations showed that the increase in the strength of Cr in the 300-500° range is not related to the appearance of a new crystalline modification of Cr. A diagram of the recrystallization of Cr, constructed with the help of microstructural and X-ray methods and by measurement of microhardness, is adduced. Full recrystallization of Cr occurs at 1020°. The hardness and the ductility of Cr after recrystallization do not decrease; the temperature of the transition of Cr from the brittle into the ductile state upon compression is decreased by 30-50°.

1. Chromium--Physical properties 2. Chromium--Crystallization 3. Chromium--Temperature factors
N. K.

Card 2/2

SAVITSKIY, Ye.M.; BURKHANOV, G.S.

Structural diagrams of titanium-lanthanum and titanium-cerium alloys. Zhur. neorg. khim. 2 no.11:2609-2616 N '57. (MIRA 11:3)

1. Institut metallurgii im. A.A. Baykova Akademii nauk SSSR.
(Titanium- Lanthanum alloys)
(Titanium-cerium alloys)

AUTHORS:

Savitskiy, Ye.M.
Shostakovskiy, M.F., Savitskiy, Ye.M.,
Kochkin, D.A., Musatova, L.V.

62-12-15/20

TITLE:

On the Comparative Efficiency of Silicon Alloys With Copper and Nickel, Applicable in Direct Synthesis of Vinylchlorosilanes (O sravnitel'noy effektivnosti splavov Kremniya s med'yu i nikelom, primenyayemykh v pryamom sinteze vinilkhlorosilanov).

PERIODICAL:

Izvestiya AN SSSR Otdeleniye Khimicheskikh Nauk, 1957, Nr 12, pp. 1493-1495 (USSR)

ABSTRACT:

In the course of a thorough analysis of the alloy of silicon with copper (which was already previously described) the authors, among other things, found that the alloy contained 50% silicon, 49% copper, and 0.4% aluminum. Also silicon alloys were investigated which contained also other metals such as chromium, manganese, and molybdenum. In other cases (with the exception of nickel and copper) negative results were obtained. From the result of the synthesis (see table) it may be seen that the silicon-nickel alloy is more active (when vinylchlorosilanes are obtained by direct synthesis). It was further shown that the silicon-nickel alloy (nickel content 15%) must be considered to be the most suitable. There are 1 table, and

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SAVITSKIY Ye.M.

✓ 6432

RECRYSTALLIZATION DIAGRAM OF IODIDE ZIRCONIUM

E. M. Savitskiy and V. F. Terekhova. (Balkov Inst. of Metallurgy, Acad. of Sciences U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 112, 276-8(1957) Jan. 11. (In Russian)

A recrystallization diagram has been constructed for the bars of iodide zirconium (99.7 Zr) prepared by cold rolling with 50% compression followed by 1 hr annealing at 600°. Deformation of these specimens was followed by cold compression from 2.5 to 90% at 10% intervals with 1 hr annealing at 500, 550, 600, 700, 800, 900, 1000, and 1200°. Annealing of the cold-rolled specimens considerably affected the size and shape of the grain. Specimens annealed in the Zr α -modification range (up to 800°) had even polycrystalline structure; the annealing in the β range (900 to 1200°) caused a sharp increase of the grain and change of the form. Röntgenograms, microstructures, table of hardness and the recrystallization diagram are presented. (R.V.J.)

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SAVITSKIY, YE. M.

20-5-35/67

AUTHOR

SAVITSKIY Ye. M., BARON V. V., IVANOVA K. N.

TITLE

Diagram of Molybdenum Recrystallization.
(Diagramma rekristallizatsii molibdena -Russian)

PERIODICAL

Doklady Akademii Nauk SSSR, 1957, Vol 113, Nr 5, pp 1070-1072 (U.S.S.R.)
Received 7/1957
Reviewed 8/1957

ABSTRACT

Apart from other factors, the size of grain is known to influence the mechanical properties of metals. In the case of molybdenum this manifests itself with particular clearness. A brittle and coarse-grained structure can be rendered more fine and uniform by a suitably selected heat treatment. In this way the material becomes more plastic and is better suited for cold treatment. Therefore the setting up of a recrystallization diagram for molybdenum, which contains the size of grain, degree of deformation, and annealing temperature, is of particular interest. As hitherto this problem had been but little investigated, the authors carried out the recrystallization of molybdenum of the first type. In order to obtain a uniform, fine initial structure, the material was several times forged at from 1600 to 1200°C. The total degree of deformation amounted to 96%. As a result of this treatment the very coarse and uneven structure disappeared. Forging at low temperatures led to the formation of texture. After annealing in the vacuum at 1300°C the samples had a polyhedral fine-grained structure with an average size of grain of about 22. - 25 µ. On the strength of these results it may be assumed that the hot for-

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"Recrystallization Diagrams of Titanium and Its Alloys," with TYLKINA, M. A., and TURANSKAYA, A. N., Titan i yego splavy; metallurgiya i metallovedeniye (Titanium and Its Alloys; Metallurgy and Physical Metallurgy), Moscow, Izd-vo AN SSSR, 1958. p 33

(Institute of Metallurgy, USSR Acad. Sci.)

"Mechanical Properties of Titanium of Various Degrees of Impurity," p 68., Ibid.
(co-authors same as above).

SAVITSKIY, Ye. M.

18(2)
 PHASE II - ABSTRACTS
 Akademiya nauk SSSR. Institut metallurgii
 Titan i yego splavy; metallurgiya i metallovedeniye (Titanium and its Alloys; Metallurgy and Physical Metallurgy) Moscow, Izd-vo AN SSSR, 1958. 209 p. 3,000 copies printed.
 Resp. Ed.: N.V. Ageyev, Corresponding Member, USSR Academy of Sciences; Ed. of Publishing House: V.S. Naumov; Tech. Ed.: A.A. Kiseleva.
 INTRODUCTION: This book, of which a Phase I Exploitation (SOV/1200) has been prepared, is a collection of scientific papers devoted to the study of titanium and its alloys from three main points of view: physical metallurgy, forming, and welding. Special problems investigated include structural changes occurring during welding, determination of the content of harmful gases, development of industrial methods of rolling, and oxidation at various temperatures.

Part I Physical Metallurgy
 Savitskiy, Ye.M., M.A. Tylkina, A.N. Turanskaya (Institute of Metallurgy, USSR Academy of Sciences) Recrystallization Diagrams of Titanium and Its Alloys 33
 The aim of this investigation, conducted in 1954-55, was to study the process of recrystallization of titanium of various degrees of purity and of its alloys under conditions of various types of deformation and to construct two types of three-dimensional diagrams of the recrystallization process. Type I diagrams show the relationship between grain size, the degree of cold working, and the temperature of subsequent annealing, and can be used in establishing correct conditions for the annealing of semifinished

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Titanium and Its Alloys (Cont.)

and finished products. Type II diagrams illustrate the relationship between grain size, degree of hot deformation, and temperature of hot deformation; they are useful in establishing optimum conditions for the forming of metals and for obtaining the desired properties in semifinished and finished products. Before the present investigation no such diagrams had been published. A study was made of the recrystallization of three types of pure titanium: (1) iodide-derived; (2) magnesium-reduced (type VT-1D), melted in an arc furnace; and (3) CaH_2 -reduced, sintered (type IMP-1). Similar studies were made for VT-2 titanium-aluminum-chromium alloy and for IMP-3 alloy (CaH_2 -reduced titanium with an addition of chromium. Diagrams of Types I and II for recrystallization under conditions of rolling and forging were established by methods of microscopic and x-ray analysis. Conclusions. 1) The following recrystallization diagrams were constructed: a) Type I for iodide-derived titanium with deformation by means of rolling; b) Type I, with deformation by static compression, and Type II, with deformation by smith forging, for technical Mg-reduced, fused, and hotrolled titanium (type VT-1D); c) Type II, with deformation by smith forging, for VT-2 alloy; d) Type II, with deformation by hot rolling, for IMP-1 titanium;

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Titanium and Its Alloys (Cont.)

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e) Type II, with deformation by hot rolling for IMP-3 alloy. 2) Because of the polymorphous character of titanium and the different capacities of the alpha and beta forms for grain growth, the recrystallization diagram should be thought of as consisting of two parts corresponding to the temperature ranges in which the alpha and beta forms exist. The alpha phase of Ti is characterized by a finegrained polyhedral structure, and insensitivity to the rate of cooling after annealing, and the existence of a critical grain size after cold deformation of 2.5-7 percent. The beta modification is distinguished by a large grain size and high sensitivity to the cooling rate, a consequence of which is the different shape and size of the grains in the hexagonal modification (α') appearing as a result of the polymorphous transformation of beta titanium in cooling. 3) In iodide-derived and commercial titanium the boundary contours of the beta grains are preserved, no matter what the cooling rate, and can be destroyed only by deformation in the alpha phase. The contours of the beta grains in CaH_2 -derived Ti and in VT-2 alloy can be preserved only by rapid cooling. 4) In the stable temperature range of the beta phase there were no indications of a recrystallization threshold or a maximum corresponding to critical degrees of deformation. This is probably due to the fact that

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Titanium and Its Alloys (Cont.)

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structural changes caused by small plastic deformations in the alpha temperature range are erased by the structural changes developing as a result of the polymorphous transformation $\alpha \rightleftharpoons \beta$ in titanium. 5) The optimum annealing temperature for obtaining alpha titanium of polyhedral structure falls within the 650-850°C range, depending on the purity of the metal and the extent of the previous deformation. More exact indications as regards the annealing temperature regime for each degree of deformation can be obtained by referring to the recrystallization diagrams. 6) Under conditions of smith forging and rolling at the rate of 0.5 m/sec, recrystallization in commercial titanium does not have time to go to completion. However, recrystallization may still set in with subsequent heating, or during the cooling of large blanks, or in further working of the still hot material. For this reason, the danger of the development of a coarse-grained structure, especially in the case of small deformations, should always be kept in mind. There are 22 figures, 5 tables, and 11 references (8 Soviet, 1 English, 1 German, and 1 Japanese).

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Titanium and Its Alloys (Cont.)

AB-1

Savitskiy, Ye.M., M.A. Tylkina, A.N. Turanskaya (Institute of Metallurgy, USSR Academy of Sciences) Mechanical Properties of Titanium of Various Degrees of Purity 68

The aim of this investigation, conducted in 1954-55, was to determine the mechanical properties of titanium produced by various methods and studied under different conditions of temperature and stress. The materials tested were: (1) iodide-derived Ti; (2) sintered Mg-reduced Ti; (3) Mg-reduced Ti melted in an induction furnace in graphite crucibles (0.5-0.8 percent C); (4) Mg-reduced Ti melted in an arc furnace with tungsten electrodes (VT-1D commercial Ti, contaminated with W); (5) sintered CaH_2 -reduced Ti; (6) cast VT-2 Ti-base alloy, with additions of 2-3 percent of Cr and 1-2 percent of Al; (7) sintered alloy of CaH_2 -reduced Ti base, with addition of Cr. Tests were made for the following mechanical properties: hardness, strength, and ductibility under compression and tension, and impact toughness. The effect of temperature on the properties was tested in the range extending from -196° to $+1100^\circ$ C in vacuum, argon, and air. Cooling to -196° was accomplished with the use of liquid nitrogen. Hardness was determined by producing an indentation with a pobedite

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Titanium and Its Alloys (Cont.)

AB-1

cone with a load of 100 kg, (for iodide-derived Ti, 15 kg) in a temperature range of -196° to $+1000^{\circ}$ C (in a current of argon when the specimens were heated above 400° C). Conclusions. 1) The degree of purity as determined by the method of preparing titanium materially affects the mechanical properties of the metal. Iodide-derived Ti of very high purity exhibits considerable ductibility (deformation of up to 95 percent in cold rolling) and withstands bending at an angle of $<180^{\circ}$ without breaking, even at -196° . Its hardness was the lowest of any of the materials tested: 132 kg/mm^2 . Contamination of the metal greatly increases its hardness (from 132 to 330 kg/mm^2) and its strength from 25 to 100 kg/mm^2 , as a result of the decrease in ductility and impact toughness. The relative hardness at 20° C of five of the materials tested is shown in the following sequence (materials arranged in ascending order of hardness): iodide titanium; VT-1D commercial Ti, Mg-reduced (W-contaminated); CaH_2 -reduced Ti, Mg-reduced Ti, melted in graphite crucibles (0.5-0.8 percent); VT-2 alloy. Differences in the properties of Ti containing 0.53-0.82 percent of C were practically undetectable. 2) Titanium is highly sensitive to the rate of deformation. An increase in the rate causes a sharp drop in ductility characteristics. 3) Lower in the temperature to -196° increases the strength and decreases

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Titanium and Its Alloys (Cont.)

AB-1

the ductility of all types of titanium. An increase in temperature brings about a rather intensive softening and a loss in strength of Ti of all types. Above 600° the difference in the mechanical properties of all types of Ti evens out, and the effect of impurities levels off. In deformation at a low rate of speed in the neighborhood of 700° the strength-reducing effect of recrystallization also begins to be seen. After a polymorphous transformation in the beta phase, titanium of all types becomes very ductile, having an extremely low resistance to deformation. 4) The mechanical properties are a sensitive indicator of structural changes taking place in titanium as a result of heat treatment. Heating of titanium of all types at temperatures above 1000° always leads to a preservation of beta-phase grain contours after cooling and transition to the alpha phase and considerably lowers the mechanical properties, especially ductility. Heating regimes in deformation and annealing were established, making it possible to obtain an alpha titanium of fine-grained polyhedral structure having optimum mechanical properties. There are 10 figures, 3 tables, and 14 references (8 Soviet and 6 English).

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5(2) PAGE 1 BOOK INFORMATION NOV/1977

Abstrakty nauk SSSR. Institut geokhimi i analiticheskoy khimii

Geochemical elements, polymers, analysis, primeneniye (Rare Earth Elements, Extraction, Analysis and Application) Moscow, Izd-vo AN SSSR, 1976. 311 p. 2,200 copies printed.

Comp. Ed.: D. I. Kravchikov, Professor; Editorial Board: I. P. Alimarin, Corresponding Member, USSR Academy of Sciences, I. M. Zolotarev, Doctor of Chemical Sciences, R. V. Kopylov, Candidate of Technical Sciences, V. I. Kuznetsov, Doctor of Chemical Sciences, M. M. Seryagin, Candidate of Chemical Sciences, and Yu. S. Sil'yarenko, Candidate of Chemical Sciences; Eds. of Publishing House: D. M. Trifonov and T. G. Levi; Tech. Ed.: B. G. Markovich.

PURPOSE: This book is intended for scientists, chemists, teachers and students of higher educational institutions, chemical and industrial engineering and other persons concerned with the extraction, preparation, use, or study of rare earth elements.

COVERAGE: This collection contains reports presented at the June 1976 Conference on Rare Earth Elements at the Institute of Geochemistry and Analytical Chemistry (Inst. V. I. Vernadsky) of the Academy of Sciences USSR. The articles treat chemical methods of separating rare earth mixtures, methods of processing rare earth ores, ion exchange chromatography, chemical analysis, and some industrial applications of rare earths. Aside from contributing authors, the editors mention the following Soviet scientists, who are working on rare earth elements, rare earth deposits, extraction methods, and the preparation of oxides and salts: Maruyev, Mal'nikov, Kuznetsov, Mal'nikov, Pleschinskii, Chernyak, Tuzhar, Belousov, Dubrovskiy, and others. V. A. Orlov, who first obtained the majority of rare earth elements in the pure state, separated many complex molecular compounds of these elements and determined their specific properties. References are given at the end of each article.

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SAVITSKIY, Ye.M.; TYLKINA, M.A.; TURANSKAYA, A.M.

Titanium and titanium alloy recrystallization diagrams. Titan i
ege splayv no. 1:33-67 '58. (MIRA 14:5)

1. Institut metallurgii AN SSSR.
(Titanium--Metallography) (Crystallization)

SAVITSKIY, Ye.M.; TYLKINA, M.A.; TURANSKAYA, A.N.

Mechanical properties of varying degree purity titanium. Titan
i ege splavy no. 1:68-81 '58. (MIRA 14:5)

1. Institut metallurgii AN SSSR.
(Titanium—Metallography) (Deformations (Mechanics))

AUTHORS: Savitskiy, Ye. M., Doctor of Chemical Sciences 30-2-42/49
Terekhova, V. F., Candidate of Technical Sciences

TITLE: Investigation of the Alloys of Rare Metals (Issledovaniye splavov redkikh metallov)
All-Union Conference (Vsesoyuznoye soveshchaniye):

PERIODICAL: Vestnik Akademii Nauk SSSR, 1958, Nr 2, pp 111-112
(USSR)

ABSTRACT: On November 18 - 20, 1957, an All Union Conference was called by the Institute for Metallurgy imeni A. A. Baykov of the AN USSR and the Board for Rare Metals at the Scientific Technical Committee of the Cabinet Council of the USSR. The conference was attended by representatives of scientific research institutes, universities and industry. Reports on raw material sources of rare metals and their production in pure state, problems of scientific investigations of alloys of rare metals, investigation results of alloys of various systems, their physical chemical properties and industrial application were delivered and discussed. Serious shortcomings hindering the development of research were pointed out. Above all, the intensification of the production of pure rare metals was demanded. The determination of the

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30-2-42/49

Investigation of the Alloys of Rare Metals.
All Union Conference

constants of physical chemical properties of pure rare metals and their alloys has to be regarded as the least investigated which hinders its rational introduction into political economy. Also systematical work in this field is carried out insufficiently. There is also a lack of information in this field; no special periodical exists. The importance of the ascertainment of new metals with addition of rare metals for the new technical was stressed. Research work must be considerably extended and carried out more quickly. For this work also the institutions of the AN USSR and their subsidiaries, the academies of the Republics of the Union, branch institutes, universities, and laboratories must join. The Institute for Metallurgy was charged with the coordination of the work. The resolution was also made to carry out the work methodically so as to shorten the necessary time and to reduce the expenses of research work. Equally the demand for an own periodical was expressed.

AVAILABLE:

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Card 2/2

1. Rare metals-Sources
2. Rare metals-Alloys
3. Scientific research-Rare metals
4. Metallurgy-USSR
5. Rare metals-Production

SAVITSKIY, Ye. M.

24-58-3-11/38

AUTHORS: Savitskiy, Ye. M., Tytkina, M. A., Tsyganova, I. A. (Moscow)

TITLE: Influence of Alloying Additions on the Recrystallization Temperature and on the Mechanical Properties of Titanium.
(Vliyaniye legiruyushchikh dobavok na temperaturu rekristallizatsii i mekhanicheskiye svoystva titana)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, 1958, Nr 3, pp 96-103 and 1 plate (USSR)

ABSTRACT: This paper is a continuation of earlier work of the authors and their team on the recrystallization and the mechanical properties of Ti of various degrees of purity and of Ti alloys (Refs. 1-6). Reinbach and Nowikow (Ref. 7) published preliminary data on the influence of certain additions (up to 1%) on the change in the time required to attain complete recrystallization of commercial Ti at a given annealing temperature; they found that introduction of chromium slows down the process of recrystallization whilst other admixtures (Co, Al, Fe, Ta and Sn) showed almost no influence on the duration of attaining complete recrystallization. In this paper an attempt is made to classify the alloying elements from the point of view of their influence on the recrystallization temperature and the mechanical properties whereby these characteristics are considered as a function of the character

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24-58-3-11/38

Influence of Alloying Additions on the Recrystallization Temperature and on the Mechanical Properties of Titanium.

of the interaction of Ti with the alloying additions, their crystal structure and also the temperature of polymorphous transformation. The relations published by Bochvar (Ref.8) and by Kurilekh (Ref.9), interrelating the recrystallization temperature of metals with their fusion temperature, are not applicable to alloys. The complexity of diffusion processes in solid solutions, the differing character of these solutions and the presence of second phases in the alloys are all factors which complicate the process of recrystallization. One important factor which has not been taken into consideration so far is the presence in metals or alloys of the phenomenon of polymorphism. In the view of the authors of this paper, in metals and alloys in which polymorphous transformation takes place, the recrystallization temperature should be closely linked with the temperature of the polymorphous transformation in addition to the influence of other factors. It is obvious that in alloys in which such transformation takes place all the recrystallization processes are fully completed in the range of existence of lower temperature

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Influence of Alloying Additions on the Recrystallization Temperature and on the Mechanical Properties of Titanium.

modifications (particularly α modification in Ti) and when the temperature of polymorphous transformation is reached, phase recrystallization and reconstruction of the crystal lattice is already proceeding. The experiments were carried out with an iodide Ti of 99.96% purity alloyed with additions of the following 14 elements: V, Nb, Fe, Co, Mn, Cr, N, C, O, Al, Be, Re, Sn and Boron. For each of the alloying additions, 4 to 5 alloys were prepared and the content of each of the additions in the alloy was chosen in such a way that alloys were obtained which are located in various phase ranges of the system, namely, alloys possessing uniform α and β structures, 2-phase $\alpha + \beta$ or $\alpha +$ chemical compound structures. The compositions of the alloys are entered in the table on p.97. Graphs are included showing the influence of the annealing temperature on the hardness, the influence of the alloying additions on the recrystallization temperature, on the ultimate strength, elongation and contraction. It was found that almost all of the investigated alloying additions bring about an increase in the recrystallization temperature. As regards the degree of their influence these elements can be subdivided into the following three groups: elements which

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Influence of Alloying Additions on the Recrystallization Temperature and on the Mechanical Properties of Titanium.

bring about a considerable increase in the recrystallization temperature at low contents of the respective element (N, O, C, Boron, Be, Re and Al); elements which bring about an increase in the recrystallization only if the content is of the order of 3% and higher (Fe, Cr, V, Mn, Sn); elements which have practically no influence on the initial recrystallization temperature (Nb and Co). The following relation was derived between the recrystallization temperature, T_1 and the temperature of the polymorphous transformation, T_2 , of the alloy: $T_1/T_2 = 0.7 \div 0.9$. For Ti this ratio equals 0.71, for low alloy alloys this ratio equals 0.7 - 0.75 and increases to 0.8 - 0.9 with increasing contents of the alloying element. The alloying additions bring about an increase in the tensile strength and hardness, maximum values being $\sigma_B = 92 \text{ kg/mm}^2$ and $R_B = 105$ and a reduction in the ductility. The greatest influence is exerted by elements which bring about a maximum increase in the recrystallization temperature and

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Influence of Alloying Additions on the Recrystallization Temperature and on the Mechanical Properties of Titanium.

belong to the first of the above-mentioned group, i.e., N, O, C, Be, B. The other investigated elements have less influence on increasing the strength and for a content of 5% these elements can be classified from the point of view of increasing the strength in the following sequence: Cr, Co, Nb, V, Mn, Fe and Sn. The greatest drop in plasticity is observed when introducing Fe, Co and Nb. There are 9 figures, 1 table and 15 references, of which 10 are Soviet, 4 German and 1 English.

SUBMITTED: April 5, 1957.

Card 5/5

1. Titanium--Mechanical properties 2. Titanium alloys--Recrystallization
3. Temperature--Effects

SAVITSKIY, Ye.M.; TEREKHOVA, V.F.

Mechanical properties and recrystallization diagram of zirconium iodide.
(MIRA 12:3)

Trudy Inst.met. no.3:181-190 '58.
(Zirconium iodide--Testing)

SAVITSKIY, Ye. M.; BARON, V.V.

Mechanical properties of silicon at various temperatures. Trudy Inst.met.
no.3:191-194 '58. (MIRA 12:3)
(Silicon--Testing)

78-3-37/47

AUTHORS: Savitskiy, Ye. M. , Terekhova, V. F.

TITLE: The Phase Diagrams of the Alloys of Lanthanum With Cerium and Lanthanum With Calcium (Diagrammy sostoyaniya splavov lantana s tseriyem i lantana s kal'tsiyem)

PERIODICAL: Zhurnal Neorganicheskoy Khimii, 1958, Vol. 3, Nr 3, pp. 756-762 (USSR)

ABSTRACT: The phase diagrams of the alloys of lanthanum with cerium, and lanthanum with calcium were investigated by thermal analysis, and by the determination of microstructure, hardness and electric resistance, and the diagrams were constructed. In the system lanthanum-cerium purest metallic cerium with 97 - 99 % purity and lanthanum with 98,5 % purity were used. Lanthanum and cerium dissolve in a liquid and solid state and form a diagram with unlimited solubility. In the system lanthanum-calcium the initial metals were molten in a vacuum under an argon atmosphere. The produced alloys were investigated by the determination of microstructure and the analyses showed that in a solid state a layer formation is to be

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78-3.3-37/47

The Phase Diagrams of the Alloys of Lanthanum With Cerium and Lanthanum With Calcium

noticed. The thorough investigation by the microstructure determination showed that in a solid state more than two layers occur. The occurrence of two layers in the alloys can already be observed at a calcium content of more than 12 ~ 15 %. With an increase in the calcium content to 30-60 % the thickness of the outer layer highly increases. By the chemical analyses, the determination of the specific weight and the hardness of the layers it was found that the upper layer consists of calcium and the lower one of lanthanum. The alloys with about 1 % calcium consist of a phase of solid solution. The alloys with 60 ~ 80 % calcium have three layers of which the middle one is of polyhedral structure and is rich in calcium. The solubility of lanthanum in calcium and of calcium in lanthanum at an eutectic temperature of 705°C is not higher than 3 ~ 5 %. There are 15 figures, 4 tables, and 8 references, 3 of which are Soviet.

ASSOCIATION: Institut metallurgii im. A. A. Baykova Akademii nauk SSSR
(Metallurgical Institute imeni A. A. Baykov, AS USSR)
SUBMITTED: June 10, 1957

Card 2/2

78-3 3-38/47

AUTHORS: Savitskiy, Ye. M. ; Baron, V. V. ; Tylkina, M. A.

TITLE: The Phase Diagrams and Properties of Gallium and Thallium Alloys (Diagrammy sostoyaniya i svoystva splavov galliya i talliya)

PERIODICAL: Zhurnal Neorganicheskoy Khimii, 1958, Vol. 3, Nr 3, pp. 763-775 (USSR)

ABSTRACT: The structural and physico-mechanical properties of the alloys of gallium with silicon and germanium in all concentrations as well as of gallium with antimony, manganese, copper and thallium with lanthanum were investigated. The phase diagram of gallium with silicon is of an eutectic type. All alloys consist of two phases. The addition of silicon to gallium highly increases the hardness and the electric resistance of silicon. The phase diagram of gallium and germanium also is of an eutectic type. The eutectic composition melts at 29°C and has a gallium content of 99.45 %. All alloys of this system possess metallic conductivity.

Card 1/3 The structure and the properties of the alloys of gallium and

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The Phase Diagrams and Properties of Gallium and Thallium Alloys

antimony were examined for hardness, microhardness, plasticity, strength and electric resistance between 20 and 600°C. Alloys with 63.59 - 64.08 % antimony at room temperature have a maximum electric resistance which decreases with a rise of temperature. This proves that these alloys possess properties of semiconductors. The structure and the properties of the alloys of gallium with 50 - 86.3 % gallium were examined by microstructure, hardness, strength, microhardness and electric resistance at temperatures of 20-300°C. The following compounds occur in the alloys: MgGa and Mg₅Ga₂. Alloys in the domain of the compound MgGa show the highest hardness and the smallest strength and plasticity. The system gallium-copper with 15 - 85 % gallium was also investigated for microstructure, hardness, strength, microhardness and electric resistance. The results showed that by the addition of gallium to copper hardness, strength and electric resistance increase, but that the plasticity decreases. The electric resistance of the alloys increases with a rise of temperature. The phase diagrams and the properties of the alloys of gallium with germanium, gallium with silicon and gallium with lanthanum were also investigated. Alloys between silicon and thallium do not occur. In the system lanthanum-

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The Phase Diagrams and Properties of Gallium and Thallium Alloys

-thallium the compound La_2Tl occurs which possesses an high electric resistance and an high hardness. There are 15 figures and 19 references, 0 of which are Soviet.

ASSOCIATION: Institut metallurgii im. A. A. Baykova, Akademii nauk SSSR
(Metallurgical Institute imeni A. A. Baykov, AS USSR)

SUBMITTED: June 25, 1957

Card 3/3

78-3-3-46/47

AUTHORS: Savitskiy, Ye. M. , Tylkina, M. A.

TITLE: Alloys of Rhenium With High-Melting Metals (Mo, Ti, Zr, Ta, Ni, Co, Cr, W, Mn) (Splavy reniya s tugoplavkimi metallami (Mo, Ti, Zr, Ta, Ni, Co, Cr, W, Mn))

PERIODICAL: Zhurnal Neorganicheskoy Khimii, 1958, Vol. 3, Nr 3, pp. 820-836 (USSR)

ABSTRACT: The investigations were performed with different physico-chemical methods, especially by the determination of the melting point. On the basis of these investigations the nature of the alloys in the case of the influence of rhenium upon high-melting metals was determined. The modification of the hardness, the melting point and the electric resistance in this system was observed. In the system Ti-Re a larger solubility domain of rhenium in β -titanium was determined. On the introduction of 15 % rhenium the β -phase of titanium is stabilized. In general the addition of rhenium to titanium increases the thermal stability. In the system Mo-Re solid solutions occur. At a temperature of 2570°C an δ -phase occurs by peritectic reaction. The boundary of the

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78-5 3-46/47

Alloys of Rhenium With High-Melting Metals (Mo, Ti, Zr, Ta, Ni, Co, Cr, W, Mn)

solid solutions of rhenium in molybdenum was not exactly determined. In the system Ta-Re in the case of 60 - 70 % rhenium the compound Re_3Ta_2 was determined. On addition of 60 - 80 % rhenium the alloys in this system are brittle and breakable. In the system Co-Re an uninterrupted series of solid solutions with an hexagonal crystal lattice between α -cobalt and rhenium was determined. In the system Ni-Re solid solutions of rhenium in nickel (α -phase) occur and solid solutions of nickel in rhenium (β -phase). The boundary between these two phase domains lies at 1200°C in the case of 40 - 75 % rhenium. In the system Cr-Re domains of solid solutions of rhenium in chromium occur. In the case of 70 - 85 % rhenium a chemical compound forms which possesses a hardness of 1000 kg/mm^2 . A smaller addition of rhenium to chromium increases the plasticity of chromium. In the system Zr-Re two chemical compounds form: 1) In the case of 50 % rhenium - ReZr_2 , with a melting point at 1900°C and an hardness of $800 - 1000 \text{ kg/mm}^2$; 2) In the case of 70 - 80 % rhenium - Re_2Zr , with a melting point at 2400°C and an hardness of 1200 kg/mm^2 . Solid solutions of rhenium in β -zirconium occur at up to 15 % rhenium. In the system Mn-Re with up to 5 % rhenium solid solutions occur. On addition of 24,6 %

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78-3-3-46/47

Alloys of Rhenium With High-Melting Metals (Mo, Ti, Zr, Ta, Ni, Co, Cr, W, Mn)

rhenum a polymorphous transformation of β to α occurs, at 760°C . In the system W-Re with 60 % rhenum a phase of W_2Re_3 forms, with a melting point at 3007°C . In this system an σ -phase also occurs at 35 - 58 At% as well as solid solutions of tungsten in rhenum at 75 % rhenum. In all investigated systems the produced alloys have a lower melting point than rhenum. There are 17 figures, 6 tables, and 35 references, 12 of which are Soviet.

ASSOCIATION: Institut metallurgii im. A. A. Baykova, Akademii nauk SSSR, Moskva
(Moscow Metallurgical Institute imeni A. A. Baykov, AS USSR)

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SOV/78-3-9-22/38

AUTHORS: Savitskiy, Ye. M., Terekhova, V. F., Novikova, I. A.

TITLE: The Phase Diagram of the Alloys of the System Magnesium-Neodymium (Diagramma sostoyaniya splavov sistemy magniy-neodim)

PERIODICAL: Zhurnal neorganicheskoy khimii, 1958, Vol 3, Nr 9, pp 2138-2142 (USSR)

ABSTRACT: The thermal analysis, the microstructure, and the determination of the microhardness were used for the construction of the phase diagram of the system magnesium-neodymium. The hardening method was used for the determination of the solubility of neodymium in magnesium in solid state. Chemical compounds of neodymium and magnesium exist in the solid solutions of neodymium in magnesium within the range of 40 - 60 percents by weight neodymium. Considerable structural changes of the alloys occur with an increase of the neodymium content up to 1%. If neodymium is added to magnesium, the hardness is increased and the mechanical properties of the alloys are improved. The strength and plasticity of the alloys in the system neodymium-magnesium in the region of the solid solution on the basis of magnesium are increased with rising neodymium content. At 150

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The Phase Diagram of the Alloys of the System Magnesium-Neodymium

and 250°C the alloys of magnesium with neodymium are considerably more solid than pure magnesium. The microstructure of the alloys changes to a great extent in alloys with 10% neodymium, they reach the maximum dispersion at 25% neodymium. There are 4 figures, 2 tables, and 7 references, 4 of which are Soviet.

ASSOCIATION: Institut metallurgii im. A. A. Baykova Akademii nauk SSSR
(Institute of Metallurgy imeni A. A. Baykov, AS USSR)

SUBMITTED: January 21, 1958

Card 2/2

SOV/24-58-4-6/39

AUTHORS: Baron, V.V., Yefimov, Yu.V. and Savitskiy, Ye.M. (Moscow)

TITLE: The Structure and Properties of Alloys in the Vanadium-Molybdenum System (Struktura i svoystva splavov sistemy vanadiy-molibden)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, 1958, Nr 4, pp 36 - 40 (USSR)

ABSTRACT: A vanadium-molybdenum phase diagram has not been published so far. As Mo and V have the same crystal lattices, similar atomic diameters and identical electron structures, it is possible to assume that these two elements form a continuous series of solid solutions. This assumption has been confirmed experimentally when measuring the lattice parameters of powder-metallurgical specimens of V-Mo. However, cast V-Mo alloys are reported to exhibit a second phase at between 10 and 60% Mo. No data on the physical and mechanical properties of these alloys exist. The authors have carried out an investigation of the structure and properties of V-Mo alloys, established their melting temperatures and constructed a phase diagram for them.

Card1/4 Alumothermal vanadium, containing 95.5% V, 0.9% Al, 0.15% Fe,

SOV/24-58-4-6/39

The Structure and Properties of Alloys in the Vanadium-Molybdenum System

0.2% C, 0.3% Si and a considerable quantity of oxygen, and molybdenum in the form of sintered rods, containing 99.00% Mo, 0.075% C, 0.04% Fe and traces of Si and W, served as raw materials. The alloys were prepared in an arc furnace, provided with an insoluble tungsten electrode, in a helium atmosphere. The voltage applied was 60 V and the current 1 000 A, the electrode diameter being 8 mm. Each alloy was remelted four times in order to ensure even mixing, and each ingot weighed 60 to 70 g. Spectroscopic analysis of the alloys for impurities showed the presence of 0.01% each of Fe, Mn and Si and traces of Mg and W. The solidus and liquidus temperatures for alloys of various compositions were determined and a phase diagram constructed (Figure 1). This shows that all alloys are solid solutions. The as-cast structures were examined and hardness values determined. The specimens were then homogenised by annealing for 10 hours at 1 600 °C in vacuo. The microstructures of the homogenised specimens were also examined and hardness, microhardness, plasticity under a compressive load and electrical resistance determined. Hardness was

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SOV/24-58-4-6/39

The Structure and Properties of Alloys in the Vanadium-Molybdenum System

measured under a 50 kg load for 30 sec, microhardness under a 50 g load.

The microstructures of the cast alloys are shown in Figure 2. The alloys with up to 30% V are single-phased. The alloys with 30-60% V show dendritic liquation and those with 80-90% V have a finely dispersed precipitate with a coarse-grained background. After the homogenising treatment (Figure 3) alloys with up to 60% V are single phased. Alloys richer in vanadium have coagulated particles (mainly Al_2O_3) in the grain boundaries and within the grains.

Homogenisation also results in grain growth. Addition of vanadium to molybdenum results in an increase in hardness. The alloys have a greater hardness before the homogenising treatment (Figure 4, Curves 1 and 2). The maximum hardness is 380 kg/mm^2 for the as-cast alloys and

315 kg/mm^2 for the homogenised alloys. Microhardness (Figure 4, Curve 3) is higher and the maximum is

Card3/4 675 kg/mm^2 at 60-70% V. The difference between the hardness

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The Structure and Properties of Alloys in the Vanadium-Molybdenum System

and microhardness values is due to the preparation of the microsections and the presence of the intergranular constituent. The hardness-composition curve is the normal type for metals forming unlimited solid solutions. The plasticity decreases with increase of the second component (Figure 4, Curve 4), especially in the region 40 - 60% V where the tensile strength is 100 - 150 kg/mm². The greatest plasticity is shown by pure molybdenum. The electrical resistance-composition curve at room temperature is shown in Figure 5. The curve is similar to the hardness curve with a maximum of 50 $\mu\Omega$ /cm at 60% V. The results obtained confirm that V and Mo form a continuous series of solid solutions. There are 5 figures and 7 references, 2 of which are Soviet, 1 German and 4 English.

SUBMITTED: November 28, 1957

Card 4/4

21(1)

AUTHORS:

Sergeyev, G. Ya., Titova, V. V.,
~~Savitskiy, Ye. M.~~, Zhul'kova, A. A.,
Nikolayeva, Z. P.

SOV/89-5-6-2/25

TITLE:

The Mechanical Properties of Uranium (Mekhanicheskiye svoystva urana)

PERIODICAL:

Atomnaya energiya, 1958, Vol 5, Nr 6, pp 618-623 (USSR)

ABSTRACT:

The test apparatus (IM - 41) with which the hardness of uranium at increased temperature and the expansion of uranium at increased temperature were investigated in a neutral gas (argon), are represented by two sectional drawings. Measuring results are given by a graph. The following details are mentioned:

The hardness of the uranium decreases with increasing temperature. If temperature rises up to 600°C, hardness decreases from 350 kg/mm² to 50 kg/mm². A regular variation of hardness in dependence on the carbon content of the uranium (0.07 to 0.24 %) was not observed.

The presence of carbon in uranium samples influences outflow pressure if these samples are pressed in the α -phase. The outflow pressure increases with an increasing carbon content

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The Mechanical Properties of Uranium

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(0.09 to 0.24 %). At 650°C and a degree of deformation of 75 % the outflow pressure increases by about 60 %. For uranium in the γ -phase outflow pressure decreases from 4 kg/mm² at 830°C to 1.8 kg/mm² at 1050°C. Ultimate strength and creep strength increase with an increasing carbon content in the uranium. In hot-rolled uranium with a C-content of 0.01 % ultimate strength is $\sigma_b = 36$ kg/mm², in uranium with 0.24 % C-content $\sigma_b = 52$ kg/mm². The creep strengths in these cases amount to 23 to 31 kg/mm². At temperatures of from 100 - 150°C all mechanical properties characterizing the strengths decrease monotonously, whereas the properties that characterize plasticity increase. For uranium with 0.12 % C-content one finds that at 750°C $\sigma_b = 12$ kg/mm², $\delta = 18$ % (relative elongation), $\psi = 51$ % (relative narrowing of the pressed surface), at 600°C $\sigma_b = 7$ kg/mm², $\delta = 23$ %, $\psi = 76$ %, and at 850°C $\sigma_b = 0.8$ kg/mm², $\delta = 31$ %, $\psi = 97$ %.

γ -uranium, which has a volume-centered lattice, has the highest degree of plasticity. The tetragonal β -uranium is inclined to be brittle, and velocity of deformation is more

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The Mechanical Properties of Uranium

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sensitive to temperature. Because of the low symmetry of the rhombic lattice of α -uranium, the latter is characterized by sharply marked anisotropic properties. There are 13 figures, 2 tables, and 3 references.

SUBMITTED: July 16, 1958

Card 3/3

129-58-8-1/16
AUTHOR: Savitskiy, Ye. M., Doctor of Chemical Science, Professor.
TITLE: Physico-Chemical Properties and Fields of Application
of Rare Metals (Fiziko-khimicheskiye svoystva i oblasti
primeneniya redkikh metallov)

PERIODICAL: Metallovedeniye i Obrabotka Metallov, 1958, Nr 8,
pp 2-17 (USSR)

ABSTRACT: In the first part (pp 2-3) a general review is given
of the properties of rare metals, in the second part
(pp 3-13) the fields of application of the following
rare metals are discussed: beryllium, cesium and
rubidium, strontium and barium; the high melting point
metals: zirconium, hafnium, vanadium (of which the USSR
has the greatest reserves of raw materials in the world),
niobium, tantalum, rhenium; the scattered rare elements:
germanium, indium, gallium, thallium, selenium,
tellurium; rare earth metals (about which very little
information is given). Most of the information contained

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129-58-8-1/16

Physico-Chemical Properties and Fields of Application of
Rare Metals

in the paper is based on published non-Russian data.
There are 22 references, 21 of which are Soviet,
1 English.

ASSOCIATION: Institut metallurgii AN SSSR
(Institute of Metallurgy, Ac. Sc., USSR)

1. Rare earth elements--Properties
2. Rare earth elements--Applications
3. Rare earth elements--USSR

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Investigations of Rhenium Problems.
Transactions of the All Union Conference

NOV 30 5 58 PM '73

of production technique, of analysis methods, of physical and chemical properties of rhenium and of its scope of applicability. Attention was directed to the insufficient production of rhenium and to the low degree of purity of the final product, to the high costs and to the slow advance of work intended to extend the raw material base. Rhenium can be used in industry for a number of special purposes, (for electric contacts, for parts in radio engineering, for thermocouples, as an addition in heat-resistant alloys and for other purposes). Immediate steps must be taken in order to increase the rhenium production. It was considered necessary to set up a special coordination commission at the Institute of Metallurgy imeni A. A. Baykov.

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SAVITSKIY, Ye.M.; BARON, V.V.; IVANOVA, E.N.

Investigation of the recrystallization of niobium and its alloys. Inzh.-fiz.zhur. no.11:38-45 N '58. (MIRA 12:1)

1. Institut metallurgii imeni A.A. Baykova AN SSSR, g. Moskva.

(Niobium--Metallography)

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Investigating rare metal alloys; all-Union conference. Vest.AN SSSR
28 no.2:111-112 P '58. (MIRA 11:5)
(Metals, Rare and minor--Congresses) (Alloys)

20-118-4-26'61

AUTHORS: Savitskiy, Ye. M., Tytkina, M. A., Tsyganova, I. A.

TITLE: The Recrystallization Diagram of Tantalum (Diagramma rekristallizatsii tantala)

PERIODICAL: Doklady Akademii Nauk SSSR, 1958, Vol. 118, Nr 4, pp. 720-722 (USSR)

ABSTRACT: There are no data in publications on the recrystallization of cast tantalum. In recent time, however, the smelting of tantalum in the arc is more and more used. The high corrosion resistance of tantalum in an aggressive medium, the low fusibility and high plasticity which permits a cold working, as well as many other properties permit to count tantalum among the technically most important metals. The diagram in question combines the grain size with the degree of deformation and the temperature of the subsequent annealing. It is therefore especially necessary for the metals worked by means of deformation. The results obtained will make possible to choose the deformation- and annealing conditions in such a way that the optimum mechanical properties of the products are guaranteed. The authors constructed a diagram of the type I for the cold working (rolling) of the cast tantalum (figure 1). The

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The Recrystallization Diagram of Tantalum

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conditions of cooling on a copper furnace bottom favored the formation of a coarse-grained structure in tantalum (figure 2a). Cast bars were cold-worked by forging until rods 7 x 7 were produced. They were annealed in vacuum at 1300° C for two hours. Thus the coarse-crystalline structure was completely transformed in a recrystallized, fine-grained, polyhedral structure (grain diameter 10-11 μ , figure 2 b). Such rods served as initial material for the experiments. The rods were cold-rolled without intermediate annealing, with a shrinkage of 2,6; 5,7; 8; 10; 15; 34; 50; 68; 83; 90; 96; 98; 6%. The rolled rods were cut into pieces of 8-10 mm length and annealed in vacuum at 1000-2500° for one hour. The line of the beginning of the recrystallization in dependence on the deformation degree is plotted in a dotted line in figure 1. The temperature of the beginning of the recrystallization of tantalum drops with the rising deformation degree from 2,6 to 84% from 1300 to 1200° C. Figure 3 gives some radiographs of tantalum. The cold-rolling up to 15% deformation distorts the lattice of tantalum and deforms the individual grains. The microstructure is, however, not considerably modified. In the case of shrinkage of more than 30% a distinctly marked rolling-texture becomes visible (figure 2 v). The grains are

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The Recrystallization Diagram of Tantalum

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changed to a great extent and extended up to ~50 - 60% shrinkage without size reduction. In the case of a deformation of 90% the grain diameter amounts to 1 - 2 μ . Annealing at 1000 - 1600° C does not lead to a considerable enlargement of the grains. A recrystallization at 1200° C leads in samples with a high deformation degree and a recrystallization at 1600° in all samples to a complete blur of the rolling texture and to the appearance of new fine crystallized grains of a diameter of 6 - 13 μ . The annealing at 1800 - 2000° C leads to an abrupt change of size of the grains in connection with a collective recrystallization (figure 2 g,d). The grain size increases at 1800° C threefold up to 31 μ and at 2000° C tenfold (up to 115 μ). The maximum sizes of the grains which correspond to the critical deformation degrees become visible in the isothermal lines of annealing at 1800 and 2000°. In the annealing at 2500° C an apparently specific property of tantalum becomes visible: the size of the grains increases to an extremely great extent (320 - 500 μ). The properties of hardness and strength of tantalum in individual deformation degrees and annealing temperatures admit the assumption that the optimum annealing treatment lies at 1300 - 1400° C. There are 3 figures and 5 references, 1 of which is Soviet.

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.The Recrystallization Diagram of Tantalum

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AVAILABLE: Library of Congress

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20-119-2-23/60

AUTHORS: Savitskiy, Ye. M., Tylkina, M. A., Povarova, K. B.

TITLE: Rhenium Recrystallization Diagram (Diagramma rekristallizatsii reniya)

PERIODICAL: Doklady Akademii Nauk SSSR, 1958, Vol 119, Nr 2, pp 274 - 277 (USSR)

ABSTRACT: Rhenium has different mechanical and physical properties which distinguish it from other metals and which are also of interest for modern engineering. Rhenium is a high melting metal, its melting point is at 3160°C. It has mechanical high strength and plasticity properties at room temperature as well as at higher temperature. The following is characteristic for rhenium: high resistance to wear, and resistance against corrosion in various aggressive media. The electric resistance of rhenium is higher than that of tungsten. Also other properties offer wide prospects for the use of rhenium in different fields of engineering. The recrystallization diagram of rhenium has hitherto not yet been published. The authors investigated the recrystallization diagrams of rhenium after cold deformation

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Rhenium Recrystallization Diagram

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(rolling) of cast and metal-powder samples. As initial material served the powder of metallic rhenium which had been reduced from potassium perenate (perenat kaliya). From this powder the samples were produced by powder metallurgical methods. These rhenium bars were melted in an arc furnace in an argon atmosphere at a pressure of 200 torr. The coarse crystalline structure of the cast metal could be removed. The samples had a recrystallized polyhedral structure with a grain diameter of 40 μ and served as initial material for the whole work. The treatment of the samples is shortly discussed. The temperature at the beginning of recrystallization was determined by means of X-ray methods from the occurrence of the first points on the diffraction rings. A diagram shows the temperature of the beginning of recrystallization of rhenium as a function of the degree of cold deformation. This temperature drops with increasing deformation degree 1750°C at 5% deformation to 1200°C at 40-60% deformation. In cold deformation of rhenium the grains were crushed. In the case of low compression degrees the formation of deformation twins is observed in rhenium. Further details are discussed. The temperature of the beginning of re-

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crystallization of powder metallurgical rhenium drops with increasing deformation degree from 1850°C at 5 % to 1500°C at 48% of deformation. A diagram shows the dependence of the size of the grains on the temperature of annealing as well as on the degree of deformation. The temperature of the beginning of crystallization of molten rhenium is lower than that of the beginning of recrystallization of powder-metallurgical rhenium which is explained by the different degree of purity of the material as well as by the presence of a microporosity in powder-metallurgical rhenium. According to the data on the recrystallization and on the change of the hardness of rhenium the optimum temperature for annealing of the rhenium deformed with a compression degree of more than 10% the temperature range from 1750 - 2400°C can be assumed. There are 4 figures and 7 references, 5 of which are Soviet.

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Rhenium Recrystallization Diagram

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ASSOCIATION: Institut metallurgii im. A. A. Baykova Akademii nauk SSSR
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